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ABSTRACT

As a result of changing welfare policies, large numbers of children of poor, uneducated mothers are likely to receive care from others as their mothers enter the workforce. How will this change affect inequality in cognitive skills among young children? Analysis of data on children of mothers in the National Longitudinal Study of Youth provides tentative evidence in support of the position that nonmaternal care tends to magnify inequality. Although ordinary least squares regressions reveal no effects of child care, fixed-effects models that control for differences between families indicate that children of high-income, well-educated mothers benefit from center-based care, but children of low-income, poorly educated mothers suffer a cognitive disadvantage from attending day care centers. Home-based care, however, is not associated with cognitive performance. Results from nonparametric analyses are consistent with the findings from fixed-effects models. The key results rely mainly on a relatively small sample of about 700 children in 300 families that sent their children to different types of care, and they do not pertain to families with only one child, so caution is warranted in generalizing the findings. (Contains 5 figures, 7 tables, and 34 references.) (Author/SLD)

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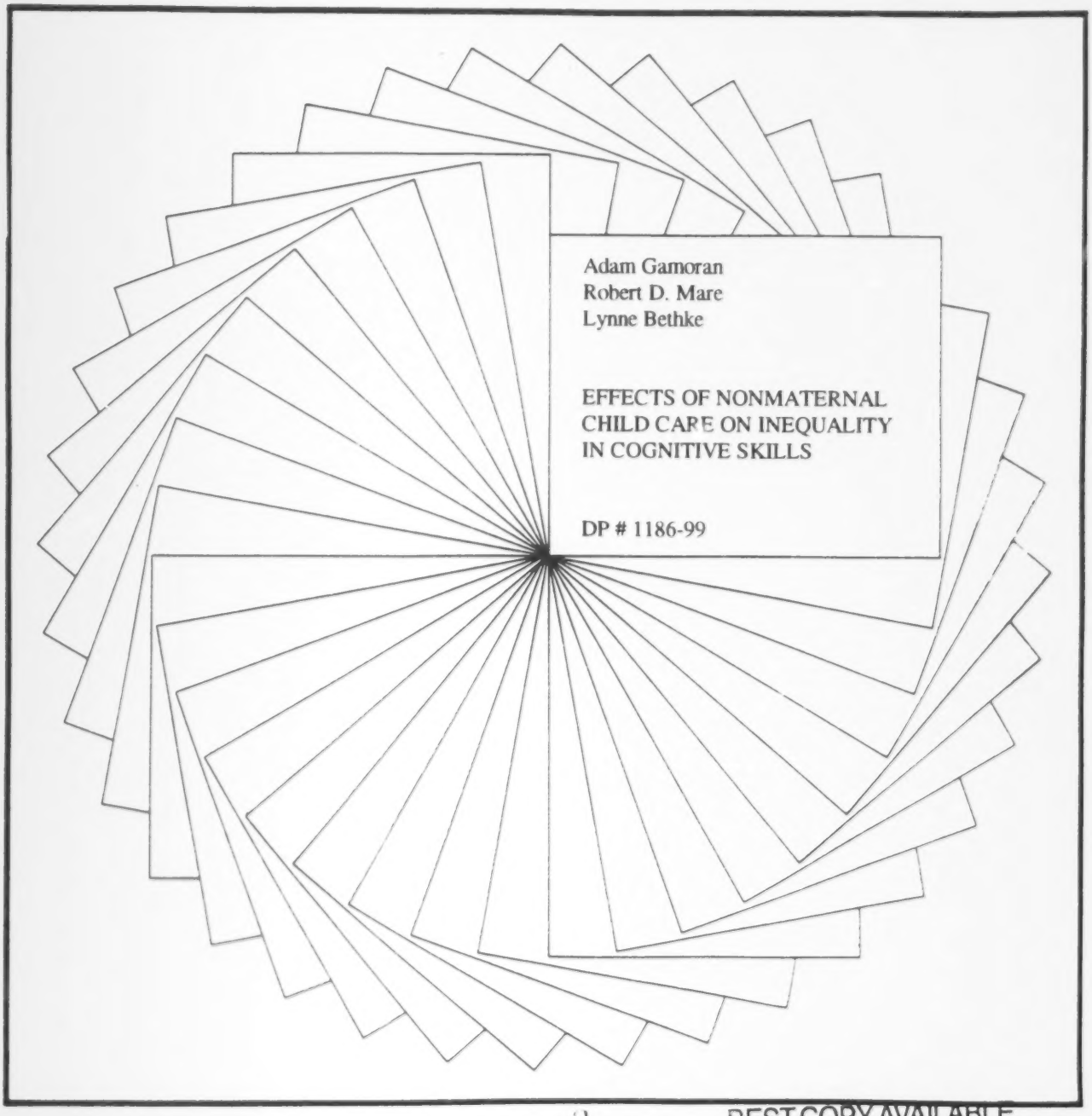

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Effects of Nonmaternal Child Care on Inequality in Cognitive Skills

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Abstract

As a result of changing welfare policies, large numbers of children of poor, uneducated mothers are likely to receive care from others as their mothers enter the workforce. How will this change affect inequality in cognitive skills among young children? One view suggests that inequality will expand because children from economically advantaged families have access to better child care, and families with well-educated parents are more likely to reinforce the cognitive benefits of care. Another view argues that inequality will diminish because even though child care may be unequal, it may be less unequal than the home environments that are supplanted by nonmaternal care. A third view suggests that because the effects of care are inconsistent, there will be little overall change in inequality. Analysis of the children of mothers in the National Longitudinal Survey of Youth provides tentative evidence in support of the first view, that nonmaternal care tends to magnify inequality. Although ordinary least squares regressions reveal no effects of child care, fixed-effects models that control for differences between families indicate that children of high-income, well-educated mothers benefit from center-based care, but children of low-income, poorly educated mothers suffer a cognitive disadvantage from attending day care centers. Home-based care, however, is not associated with cognitive performance. Results from nonparametric analyses are consistent with the findings from fixed-effects models. The key results rely mainly on a relatively small sample of about 700 children in 300 families that sent their children to different types of care, and they do not pertain to families with only one child, so caution is warranted in generalizing the findings.

Effects of Nonmaternal Child Care on Inequality in Cognitive Skills

Social inequality in cognitive skills is evident even before children begin formal schooling. Kindergartners and first graders from families at varied social and economic levels exhibit differences in reading readiness and counting abilities (Coleman et al., 1966; Barr and Dreeben, 1983; Alexander and Entwistle, 1996). Cognitive gaps tend to expand over the schooling years, but they are present from the beginning.

Differences in children's social environments constitute a major source of inequality in cognitive development. Children from poor families often suffer from inadequate health and nutrition, undoubtedly hampering their intellectual growth (Federal Interagency Forum on Child and Family Statistics, 1998; National Education Goals Panel, 1997). Children from different types of families also vary in the cognitive stimuli available in their environments, from listening to bedtime stories, to watching Sesame Street, to visiting libraries, to being spoken to frequently by parents and other caretakers (Cook et al., 1975; Carnegie Task Force on Learning in the Primary Grades, 1996; Federal Interagency Forum, 1998; National Education Goals Panel, 1997). Children whose parents are less educated may also face a mismatch in communicative styles between the home and the school, and therefore have less opportunity than children of more-educated parents to develop and exhibit the sort of talk and information that counts as "cognitive skills" in schools and the wider society (Bernstein, 1975; Heath, 1983). These inequalities appear early on and persist throughout childhood.

Imminent changes in social policies may have profound implications for these inequalities. With the elimination of the federal program of Aid to Families with Dependent Children, most women who would formerly have received government assistance are being pushed into the workforce, even though they may have very young children at home. Programs vary from state to state, but in general mothers with no other means of support will be required to enter the labor market by the time their youngest child is 1 year old or less, entrusting the care of their children to others (Jacobson, 1997). Thus, in the near

future many more children than at present, especially those of poor, relatively uneducated mothers, will be found in child care settings supervised by persons other than their mothers.

How will this change affect the degree of cognitive inequality among children as they enter formal schooling? Will the increase in nonmaternal child care mitigate the inequalities that result from unequal home environments? Or will child care compound the inequalities that already exist? We cannot make firm predictions, but we can shed light on the future by examining effects of child care in the present. What are the effects of various forms of nonmaternal child care? Most important, how do these effects vary among children whose mothers differ in their social and economic circumstances? By comparing children who currently receive nonmaternal care to those who do not, at different socioeconomic levels, we can get a sense of whether child care tends to exacerbate or reduce cognitive inequalities. From this assessment we may speculate on the likely implications of the latest policy developments.

CHILD CARE AND INEQUALITY

The organization of care for young children differs from K-12 education in two ways that are crucial for our study. First, in contrast to elementary and secondary schools, which at a given level are relatively similar across the nation in structure and curriculum, settings for the care of young children are not standardized, but instead occur in a wide variety of contexts. Therefore, when one examines the effects of child care, it is important to consider the different types of settings in which the care takes place. Second, whereas K-12 education is publicly funded, care for young children is for the most part privately funded. Consequently, questions about variation in quality are even more important for early child care than for elementary and secondary schooling.

Child Care Settings

Child care settings may be grouped into three main categories: the child's own home, another home, and a center of some sort. Care in the child's own home may be provided by the father or another relative, a friend or neighbor, or another nonrelative hired for that purpose. Care in another home, often called family day care, may be offered by a friend or relative, but more typically a paid provider fills this role (Hofferth et al., 1994). Center-based care includes preschools, nursery schools, and day care centers. Head Start, the federal compensatory education program for poor children aged 3 to 5, is a type of center-based care. Although a distinction is sometimes drawn between day care centers and preschools, contemporary writers argue that there is no consistent difference, because many day care centers offer an educational component that is indistinguishable from that of nursery schools and preschools, and the latter provide custodial care just as day care centers do (Hofferth et al., 1994; Carnegie Task Force, 1996).

Access to Child Care

Overall, three-fourths of the funding of child care for prekindergarten children comes from the families of children enrolled (Carnegie Task Force, 1996). Because child care is privately funded, one may expect that families with greater economic resources gain access to more expensive types of care, and this is indeed the case. Swadener (1995) suggested that as children reach ages 3 and 4, well-off families often find places for their children in nursery schools that poorer families cannot afford. Children of poor families may remain in home-based settings, generally with providers who have had no special training for their roles. This pattern is confirmed by recent surveys. For example, a 1996 survey of American households indicated that 55 percent of prekindergarten children received care in a preschool, nursery school, or day care center. However, this percentage varied by family income, ranging from 43 percent among those with incomes of $10,000 or less to 79 percent among those with incomes over $75,000 (National Education Goals Panel, 1997). Similarly, whereas 12 percent of children aged 0

to 2 were in center-based care, parents in the highest income category placed their children in such settings at more than twice the rate of those in the lowest income category (21 percent versus 9 percent). A comparable pattern occurs according to parents' education, with children of more-educated parents more likely to attend center-based programs (National Center for Education Statistics, 1995). Even though poor children have access to center-based programs through Head Start, the Carnegie Task Force (1996) reported that fewer than half of eligible children are enrolled.

Inequality across Child Care Settings. Caregivers in home-based settings often lack relevant training and credentials. A 1990 survey indicated that whereas 93 percent of center-based providers had some child care training, the comparable figure was only 64 percent for providers in homes (National Education Goals Panel, 1997). In addition, 36 percent of center caregivers had teacher training and 24 percent had a child care associate's degree, compared to 0 and 6 percent, respectively, among the home-based providers. However, it is not certain that differences in training imply differences in the quality of care for children. The NICHD Early Child Care Research Network (1996) discovered that observer ratings of care quality were only weakly associated with providers' child-care training. Consequently, the better credentials of center providers do not necessarily mean that centers offer better care than homes.

In the NICHD study, quality of care was more strongly associated with group size and adult-child ratios. Settings with smaller groups and fewer children per adult were rated as offering better care. Small groups and lower ratios are more characteristic of home care environments than of center-based care, suggesting that, on average, better care may be found in homes than in centers. Yet Blau (1997) has questioned the validity of group size and adult-child ratio as indicators of the quality of care, because he found they lacked a positive impact on children's behavioral and cognitive development.

Clearly, children whose parents differ in their levels of income and education have differential access to center-based care. This pattern may contribute to an unequal quality of care for children from varied backgrounds, but the evidence is not conclusive.

Inequality within Types of Child Care Settings. Within types of care, there is clear evidence of better conditions for children whose families have greater social and economic advantages. Wrigley (1991) reported that, historically, charity day care facilities for the poor were substandard compared to care received by more-advantaged children in nursery schools. The Carnegie Task Force (1996, p. 57) concluded that at present, "with the notable exception of Head Start and some exemplary state-funded programs, programs attended by lower-income children do not ordinarily provide the full range of child development, health, and parent services that help children get ready for school." The Task Force noted that for-profit centers, in which low-income children are overrepresented, often fail to meet quality standards of training and adult-child ratios. Moreover, a survey of accredited centers revealed that the more low-income children served by a center, the lower were teacher salaries (General Accounting Office, 1990). In another study, higher-paid teachers were found in centers rated as providing higher-quality care (Carnegie Task Force, 1996). Thus, low-income children may receive less-adequate care because they have lower-paid teachers.

Based on observations of teacher behavior, Phillips et al. (1994) concluded that centers serving high-income children consistently offered better care than centers serving middle- and low-income children. On some criteria, such as "use of developmentally appropriate activities," the middle-income centers were rated as providing the lowest quality. On other criteria, notably the quality of teacher-child interaction, the low-income centers were rated lowest. Teachers in centers serving predominantly low-income children were observed acting both more harshly and in a more detached fashion than teachers serving middle- and high-income children. The Carnegie Task Force (1996) was especially concerned about the quality of care received by children of the "working poor," families that did not qualify for subsidies but which could not afford high-quality care. Duneier (1995) provided a compelling account of the struggles of a mother in this situation to provide care for her daughter through a patchwork

combination of hired providers and friends. Thus, in both center and home settings, there is reason to believe that children from more-advantaged families receive better-quality care.

Unequal Child Care and Cognitive Inequality

What are the implications of the variety of child care settings and patterns of access and quality for cognitive inequality among young children? Do current configurations tend to increase or reduce inequality, or is the use of nonmaternal care irrelevant for children's cognitive outcomes? In thinking about these questions, it is essential to bear in mind not only the inequality in children's experiences of nonmaternal care but also the inequality in the family environments for which child care is substituting. Evidence of child care inequality exists, but inequality in children's everyday lives also exists, as has been documented in countless studies. What does this imply for cognitive outcomes?

Child Care May Exacerbate Inequality. One view of these patterns suggests that the use of nonmaternal care tends to increase cognitive inequality among young children. Overall, research on the effects of early care on cognitive outcomes yields mixed results (Barnett, 1992). Only in the case of high-quality programs is there clear evidence that child care enhances cognitive development (Carnegie Task Force, 1996). High-quality programs are especially effective for children from disadvantaged families (Barnett, 1992). However, children whose parents have less money and less education have less access to high-quality programs. Despite a few highly publicized examples of high-quality Head Start programs, most poor children—including the many eligible children who do not attend Head Start, and children from "working poor" families—probably do not enroll in programs of the highest quality. One study has reported negative effects on cognitive skills for poor children enrolled in center-based care (Baydar and Brooks-Gunn, 1991).

Overall, Head Start has positive effects on learning, at least in the short term (Barnett, 1992; Currie and Thomas, 1995, 1996). Because children enrolled in Head Start are all from very poor families, we cannot learn from these results whether the gains are equal to the benefits of high-quality programs

attended by children from wealthier families. If access to Head Start is restricted by limited funding, but access to high-quality programs responds to increasing demand from families that can pay (Fuller and Liang, 1996), then an increase in nonmaternal care may exacerbate inequality, despite the benefits of high-quality Head Start programs.

Hence, there are two bases for the view that nonmaternal care tends to magnify inequality. The first has to do with differential *access*: More-advantaged families have greater access to center-based care, which tends to be more stable with better-trained providers than is care in the child's home or another home. There is no doubt that advantaged children are more likely to attend centers, but the evidence is not conclusive about whether center-based care is more beneficial than home-based care. The second basis, which is more complex and is the main focus of our research, has to do with differential *effects*: Even when different families place their children in similar types of care, the care may not have the same impact on all children. First, families that can afford to pay more are likely to place their children in higher-quality settings, whether center-based or home-based. (In this respect the very poor may be better off than the "working poor," who lack access to subsidized care and cannot spare much of their income to pay for child care.) Second, even identical care may not have the same consequences for children from different backgrounds. For example, types of parent-child interaction that are common in middle-class families, such as reading and counting activities, may reinforce preschool instruction and thus magnify its positive impact over the benefits of the same care when received by children in poor families, who have less experience with such "instructional" interactions in their homes (Heath, 1983).

Child Care May Reduce Inequality. Another view holds that child care may reduce cognitive inequality among young children. According to this view, inequalities in the provision of child care are overshadowed by inequalities in the families from which the children are coming (Barnett, 1995). For this view to hold, it is not necessary that child care for rich and poor children be of equal quality. Child

care would still reduce inequality if the quality of care were *less unequal* than the quality of the environments for which the child care is substituting.

The case of elementary education illustrates this point. During the school year, children from advantaged and disadvantaged families learn at roughly the same rate (Heyns, 1978; Alexander and Entwistle, 1996; Gamoran, 1996). During the summer, when school is not in session, cognitive growth continues for middle-class children but falls off for children from poor families. Thus, the school serves as a buffer against unequal home environments. Cognitive inequality expands over children's school careers, but this is because of unequal learning during the summer and is not a result of the schools themselves, at least through the elementary grades (Gamoran, 1996). The same pattern may hold for preschools and day care centers: Though they are stratified, they may be less unequal than the families from which the children enrolled are coming, and the cognitive effects of center-based care may be less unequal than the cognitive effects of families at different socioeconomic levels. If that is the case, then center-based care in particular may tend to reduce cognitive inequality, even if children from advantaged families receive better care.

Evidence that nonmaternal child care may reduce cognitive inequality comes from two analyses of mothers and children from the National Longitudinal Study of Youth (NLSY), the same source of data we will use for our investigation. Desai, Chase-Lansdale, and Michael (1989) uncovered negative effects of maternal employment on children's cognitive skills, but only for boys from high-income families. Caughy, DiPietro, and Strobino (1994) detected negative effects of care in centers and in children's own homes, but only among children whose maternal home environments were rated as high quality by observers. Both sets of authors interpreted their results as indicating that nonmaternal care is detrimental when maternal care is of high quality. However, neither addressed precisely the question of differential access to and quality of care for children who differ in their social and economic backgrounds. Desai, Chase-Lansdale, and Michael focused on maternal employment, not child care, and Caughy, DiPietro,

and Strobino found interactions with home environment but not family income, and they did not examine other aspects of social background. Moreover, both studies relied on statistical controls in least squares regression to account for differences among families using different types of care. Yet Currie and Thomas (1995) have shown that effects of care in these data may be obscured unless unmeasured aspects of family backgrounds are also taken into account. Thus, the NLSY analyses have been suggestive but not conclusive.

Child Care May Have No Impact on Cognitive Inequality. A third possibility is that the nature and type of care—maternal or nonmaternal, center or home-based—is irrelevant for inequality in cognitive development. This pattern would hold under either of two circumstances: (a) if child care makes no contribution to cognitive growth, positive or negative, or (b) if the inequalities of families are exactly mirrored by the inequalities of nonmaternal child care. The first seems unlikely because researchers have observed positive effects of care on cognitive skills, at least when the care is of high quality (Barnett, 1992; NICHD, 1996). The second seems plausible for home care, particularly for care in the child's own home, which may well replicate the child's circumstances under maternal care. Thus, home care may have no impact on inequality, whereas center care probably does matter. Whether the impact of center care is to increase or reduce inequality depends on whether the stratification of child care is more or less severe than the stratification of families.

Formal Models of Child Care and Inequality

We can formalize these ideas using elementary linear models. Let y denote a child's score on a measure of cognitive development, C be a dichotomous variable that equals 1 if a child experiences nonmaternal child care, and X be an indicator of the socioeconomic standing of the child's family. A simple additive model of children's cognitive development, which allows only for additive positive effects of socioeconomic status and child care, is

$$y = \mu + \kappa X + \pi C + \epsilon \qquad (1)$$

where ϵ is a random disturbance and μ, κ, and π are parameters with values greater than 0. If child care and parental socioeconomic status are complementary—that is, if the parents with higher or lower socioeconomic status are better able to reinforce the lessons of child care or, equivalently, child care is organized to provide more help to the children of higher or lower status parents—then the model should include a multiplicative interaction between X and C

$$y = \mu + \kappa X + \pi C + \rho XC + \epsilon', \tag{2}$$

where the sign of ρ may be positive or negative depending on whether nonmaternal care works to the advantage of children from high- or low-status families.

We can obtain some insight into how child care and socioeconomic status may interact by considering the possibility that the *quality* of the care that children experience not only affects their outcomes but also varies with socioeconomic characteristics of children. That is, suppose that the degree to which nonmaternal care benefits children depends on the quality of the care. Net of quality, however, assume that care does not benefit more- or less-advantaged children. Let Q^C be a scalar measure of the quality of care. Then a model of these effects is

$$y = \alpha + \beta X + \gamma C + \delta Q^C + \eta C Q^C + \omega', \tag{3}$$

where

$$Q^C = \mu^C + \theta^C X + \epsilon^C, \tag{4}$$

ω' and ϵ^C are random disturbances, and β, η, and θ^C are all greater than 0. Equation 4 indicates that quality (Q^C) is a function of socioeconomic status (X). With our data, it is impossible to estimate this model because we lack observations on Q^C. We can, however, estimate a reduced form of Equation 3, by substituting Equation 4 into Equation 3. This is just Equation 2 with the constraints that

$$\kappa = \beta + \delta\theta^C,$$

$$\pi = \gamma + \eta\mu^C,$$

$$\rho = \eta\theta^C > 0.$$

Under this model, nonmaternal child care widens the gap between higher and lower socioeconomic groups if the care experienced by more-advantaged children is of better quality than the care experienced by their less-advantaged counterparts.

The argument, however, is more complex if we recognize that the children of more-educated or higher-income parents may enjoy better environments not only in their nonmaternal child care but also at home under maternal care. Both maternal and nonmaternal child care environments may widen the gap in cognitive achievement between children from more- and less-advantaged backgrounds. Whether the increased use of nonmaternal child care widens or narrows these gaps, therefore, may depend on which environment—maternal or nonmaternal care—produces larger socioeconomic inequalities. We can represent this idea in the following model. Assume, without loss of generality, that children spend almost all of their time in either nonmaternal child care or at home with their mothers. That is, a child's development is predominately affected by *either* the maternal home environment *or* the child care environment.[1] Let Q^M be a scalar measure of the quality of maternal care. Then a revised model for cognitive development is

$$y = \alpha' + \beta'X + \gamma'C + \eta^C CQ^C + \eta^H(1-C)Q^M + \omega^y, \tag{5}$$

where

$$Q^C = \mu^C + \theta^C X + \epsilon^C, \tag{4}$$

$$Q^M = \mu^M + \theta^M X + \epsilon^M, \tag{6}$$

ϵ^H is a random disturbance, and β, η^C, η^M, θ^C, and θ^M are all greater than 0. If measures of the quality of maternal environment and child care are unavailable, we must estimate the reduced-form effects of X and C, which is again Equation 2:

$$y = \mu + \kappa X + \pi C + \rho XC + \epsilon^y. \tag{2}$$

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[1]A more elaborate version of the model would take into account the amount of time spent in the maternal and nonmaternal care environments. Such a refinement, however, would not alter the conclusions of this discussion.

In this case, however, the reduced-form parameters are:

$$\kappa = \beta',$$

$$\pi = \gamma' + \eta^C \mu^C - \eta^H \mu^H,$$

$$\rho = \eta^C \theta^C - \eta^M \theta^M.$$

Under this model, the reduced-form parameter for the interaction between parental socioeconomic status and use of nonmaternal child care depends on the effects of the quality of the maternal and nonmaternal care environments and the effects of socioeconomic status on the qualities of the maternal and nonmaternal care environments. If maternal and nonmaternal care environments affect child outcomes to an equal degree (that is, $\eta^C = \eta^M$), then the sign of the interaction between socioeconomic status and use of child care depends on whether it is the child care or the maternal environment that is more unequal across families with varying socioeconomic characteristics. If, in addition, the effects of socioeconomic status are similar for the quality of maternal environment and child care (that is, $\theta^C = \theta^M$), child care has no effect on the cognitive gap between children from different socioeconomic groups (that is, $\rho = 0$). [2]

DATA AND METHODS

Data for our study come from the mother-child sample of the NLSY (Mott, 1995). The survey began in 1979 with over 12,000 young men and women aged 14 to 21. By 1992, of nearly 5,000 women remaining in the sample (now aged 27 to 34), over 3,000 had given birth to a total of more than 7,000 children. These children are the main focus of our research.

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[2]The outcome of no effect could also arise in the special case where $\eta^C \neq \eta^M$ and $\theta^C \neq \theta^M$, but $\eta^C \theta^C = \eta^H \theta^M$ (that is, child care and maternal environments have different effects, and the effects of social background differ between child care and maternal care, but the interaction of care effects and background effects turn out to be equal across the two different care environments). This possibility cannot be ruled out without data on the quality of maternal and nonmaternal care, but it is not predicted by any of the theoretical viewpoints we have considered.

NLSY respondents have been resurveyed annually. The interviews of 1984–86, 1988, and 1992 obtained a variety of details about child care arrangements for children of the NLSY mothers, both current and, retrospectively, for the first 3 years of each child's life. In particular, NLSY mothers reported who cared for their children and in what location.

The children themselves were interviewed and responded to a battery of assessments in 1986, 1988, 1990, and 1992. These assessments included cognitive tests as well as psychological inventories. Even infants responded to the simplest exercises, and more complex tests and questions were posed to older children. Our analyses focus on assessments given after age 3 (the latest age for which complete child care information is available), specifically cognitive tests at ages 3, 4, 5, and 6. We focus on these tests because they are the most proximate to the care experiences that we are examining. Focusing on children with cognitive tests from ages 3 to 6 means we are including those who were no more than 6 years old in 1986 (the first year child assessments were administered) and no less than 3 years old in 1992 (the most recent year for which data are available). Thus, our study examines children born between 1980 and 1989, which narrows our focus to about 5,000 children.

Data on children's family background are exceptionally rich in the NLSY child sample because the children's mothers have been interviewed since before the children were born. Information is available on educational, employment, and marital history as well as on family income for NLSY mothers. All children of NLSY mothers were targets of the data collection, so for many families, more than one child is included in the sample.

Child Care Indicators

Indicators of child care for our study come from retrospective questions for mothers. In 1990 and 1992, mothers were asked whether each child was cared for in any regular child care arrangement, such as by a relative or nonrelative in the child's own or other home or in a day care center or preschool, for a month or more, during the child's first, second, and third years of life. In addition, mothers were asked

the number, types, and durations of child care arrangements for each child. Our measure of care type is the arrangement that was used for the greatest number of months, which in almost all cases was the same as the first arrangement listed. Table 1 shows that the percentage of children receiving no regular nonmaternal day care declined from about 60 percent in the first year to just over 50 percent in the third year. Very few children attended schools or centers in the first 2 years of life; even by the third year only 10 percent were in day care centers and less than 6 percent regularly attended nursery or preschools. Percentages of children receiving care in their own and other homes remained steady at around 11 percent and 24 percent, respectively, over the children's first 3 years of life.

Because of the small number of cases in nursery/preschools and day care centers, and because preliminary analyses indicated similar patterns for the two types of home care (own home and other home) and the two types of center care (nursery/preschool and day care center), we have combined categories to focus on three care situations: home care, center care, and no nonmaternal day care. Preliminary analyses also indicated no effects for care in years 1 and 2, possibly because the number of children in center care was too small to detect significant effects, or because the amount of exposure to nonmaternal care was too slight to make a difference for many children. Consequently, in our analyses we focus on effects of care in year 3, i.e. when the child was between 2 and 3 years old. Children for whom care type was not reported were included in the analyses with a dummy variable indicating that care was unreported.

Tests of Cognitive Skills

We employed two tests of cognitive skills to assess the effects of different types of care. The Peabody Picture Vocabulary Test – Revised (PPVT) measures hearing vocabulary by asking children to identify one of four pictures which best describes a word's meaning (Dunn and Dunn, 1981). The PPVT was administered to NLSY children beginning at age 36 months. For our analyses, we used the first score available beginning at 36 months and up to 83 months of age, so that we are examining scores for

TABLE 1

Child Care during the First 3 Years of Life

Setting	Year 1	Year 2	Year 3
Child's home	11.4%	11.6%	11.2%
Other home	23.9%	25.8%	22.6%
Nursery/preschool	0.4%	1.7%	5.5%
Day care center	3.6%	6.9%	10.0%
No day care	60.7%	54.0%	50.7%
TOTAL	100%	100%	100%
Unweighted n	6,322	5,876	5,376

Note: Data are weighted using the 1992 NLSY child weights.

children aged 3, 4, 5, and 6 years. (For about two-thirds of the children, the test score came from age 3 or 4.) The PPVT has been standardized on a national sample to have a mean of 100 and a standard deviation of 15. In our sample, the mean is lower and the standard deviation is greater (see Table 2). As other analysts have noted, the NLSY child sample tends to overrepresent children from disadvantaged backgrounds because the NLSY women have not all completed their childbearing, and those who have children sooner tend to be more disadvantaged than the average (Desai, Chase-Lansdale, and Michael, 1989). This sampling constraint is no doubt the reason for the low average scores on the PPVT. PPVT results are available for about 4,500 children at ages 3 to 6, or about 90 percent of the targeted portion of our sample.

We also used the mathematics test from the Peabody Individual Achievement Test (PIAT-Math), a test that begins with early skills such as recognizing numbers and progresses to advanced topics such as geometry and trigonometry (Baker et al., 1993). NLSY children took the PIAT-Math beginning at age 5, and we have used the first score available for all 5- and 6-year-olds (i.e., children between 60 and 83 months of age). This test was also standardized on a national population to have a mean of 100 and a standard deviation of 15. In contrast to the PPVT, the PIAT-Math scores of children in our sample are very close to the sample norms (see Table 2). It is not clear why our sample is more similar to the national norms in mathematics than in early verbal expression. About 3,300 children within our age restrictions provided PIAT-Math scores, also about 90 percent of the sample within the target range of ages 5 to 6.

Background Variables for Mothers and Children

Data on mothers included scores on the Armed Forces Qualification Test (AFQT), "a general measure of trainability" (Center for Human Resources Research, 1995) administered to NLSY subjects in 1980. Because the women were at various ages when they took the AFQT, we regressed AFQT on age and used the residuals as our measure of AFQT in the analyses. Mothers reported their own ages and

total years of education at the birth of each child, and the number of siblings each child had at age 3, and these are included as well. We measured family income by taking the log of the family's average income (in 1992 dollars) for the years when the child was age 0 to 5. We also included a dummy variable indicator for poverty status. This variable was created by dividing average family income (in 1992 dollars) by the number of people in the family when the child was 3 years old and then comparing the resulting value to 1992 poverty thresholds.

Table 2 provides means and standard deviations for the sample we use in our main analyses, and separately for children in each of the three types of care. (Missing data on background variables were recoded at the sample means, and dummy variables to indicate missing data were included in the analyses.) As expected, children in center-based care tend to have more-educated mothers and higher family incomes than do children who received no nonmaternal day care. This is the case even though blacks are highly overrepresented in center-based care: They constitute just under 18 percent of the weighted sample but 31 percent of the children in center care. Interestingly, children in home care are also socially and economically advantaged compared to those who received no day care. These descriptive data suggest that socioeconomically disadvantaged children have less access to all types of nonmaternal care. Whether that pattern works to the benefit or detriment of disadvantaged children remains to be seen.

Statistical Methods

A problem with exploring effects of different kinds of child care experiences is that children are not randomly assigned to different programs, so what appear to be the effects of program types may actually reflect differences among children enrolled in various programs. We have taken two steps to address this problem of selection. First, we estimate ordinary least squares (OLS) regression models with covariates introduced to control for differences among children and their families. The OLS model is equivalent to the reduced-form model we presented in Equation 2, with the provision that C represents

TABLE 2
Characteristics of Children and Their Mothers

	CHILD CARE SETTING (YEAR 3)				
	Home Care	Center Care	No Day Care	Care Unreported	TOTAL
Child Characteristics					
Male (percent)	48.39	51.88	53.52	50.88	51.66
Black (percent)	14.14	31.13	17.06	17.90	17.84
Hispanic (proportion)	8.71	5.54	9.17	11.52	8.71
Age when tested (months)	71.02	71.71	70.98	71.26	71.90
	(6.59)	(6.51)	(6.79)	(6.21)	(6.67)
Siblings at age 3	1.27	1.31	1.50	1.48	1.41
	(0.59)	(0.63)	(0.83)	(0.67)	(0.74)
Motor skills	100.70	100.91	99.83	100.22	100.24
	(11.63)	(11.08)	(11.26)	(12.73)	(11.42)
PPVT	92.87	92.97	89.17	91.75	90.93
	(19.25)	(20.94)	(20.82)	(16.85)	(20.27)
PIAT-Math	100.10	102.91	98.75	99.44	99.67
	(13.09)	(14.10)	(13.40)	(13.79)	(13.46)
Mother Characteristics					
Mother's age at child's birth	24.64	24.62	24.66	24.39	24.64
	(2.26)	(2.14)	(2.24)	(2.50)	(2.24)
Mother's educ at child's birth	12.36	12.79	11.72	12.07	12.05
	(1.70)	(1.84)	(1.94)	(2.09)	(1.91)
Mother's AFQT	711.34	701.75	623.36	679.52	661.56
	(187.99)	(187.83)	(221.62)	(205.25)	(211.44)
Log family income	10.32	10.40	10.05	10.25	10.18
	(0.63)	(0.71)	(0.77)	(0.69)	(0.73)
In poverty (percent)	11.11	7.48	28.63	15.56	20.30
Unweighted n	581	239	1086	102	2008
Weighted percent	30.30	11.57	54.08	4.41	100.00

Notes: Figures are means, with standard deviations in parentheses. Data are weighted using the 1992 NLSY child weights. Unweighted number of cases is 3,143 for PPVT and 2,008 for PIAT-Math and all other variables. The sample is restricted to children with at least one sibling in the selected age ranges.

multiple settings for nonmaternal care that must be distinguished in the analysis, and *X* represents a variety of control variables, some of which indicate family background and thus must be interacted with *C* to test our model.

Second, we take advantage of the fact that many mothers have more than one child in the sample to estimate fixed-effects models, in which all variables are deviated from their family means. This procedure rules out all between-family variation, thus controlling for unmeasured as well as measured differences between families. Currie and Thomas (1995) have shown that fixed-effects models effectively reduce selection bias in the NLSY data.

The fixed-effects models are necessarily restricted to children in families with at least two children in the sample. This procedure reduces the sample size to 2,008 for the PIAT-Math and 3,143 for the PPVT. Selection bias is potentially a major problem for the analysis of care effects, and consequently we have more confidence in the fixed-effects results than in OLS estimates. However, this approach limits the generalizability of our conclusions. Fixed-effects models rely on information from families that sent different children to different types of care to estimate within-family differences in outcomes. There were 296 such families with 670 children in our sample for analysis of PIAT-Math scores, and 458 families with 1,083 children in our PPVT sample. Also, whereas sample means and standard deviations changed very little when we eliminated children who had no siblings within our age restrictions, our OLS results using the restricted sample could not always be replicated using OLS on the full sample. Consequently we limit our claims of generalizability to families with at least two children.

Many children took the tests more than once, and ideally we could use multiple test scores to estimate fixed effects for children within families, thus controlling not only for unmeasured differences between families but also for unmeasured differences between children within families. However, preliminary work indicated there were not enough cases with multiple test scores to estimate such models successfully (Bethke, 1997). Consequently, we rely on child-specific variables such as sex, motor skills,

and family income specific to the child's own first 5 years of life to control for between-child, within-family differences.

Our reliance on preliminary analyses to establish our models led us to be concerned about the sensitivity of our models to the specifications we selected. Consequently we also use nonparametric methods to confirm the robustness of our results when modeling restrictions are relaxed. We use a kernel regression procedure to examine differences between children in different types of care and from varied socioeconomic levels, without imposing a particular functional form on the estimation of the differences.

RESULTS

Table 3 presents the effects of home care and center-based care on PIAT-Math and PPVT results, compared to the reference category of no nonmaternal child care. In this analysis no interactions are allowed, so the effects of care are assumed to be the same for all children. We provide two sets of results for each dependent variable, one based on OLS regression and the other using fixed-effects methods. Neither method turns up any significant cognitive differences among children receiving different types of care.

Table 3 also provides coefficients for the mother and child characteristics that are included in the models as control variables. These results are generally as one would expect. In the OLS results for both dependent variables, children from minority backgrounds and those whose mothers have low AFQT scores, low levels of education, and who were in poverty tended to score lower on the tests. Income has no independent effect beyond the impact of poverty. Children who were born to younger mothers, who had more siblings, and who were younger themselves when they took the tests, also scored lower, while children whose infant motor skills were better scored higher on the cognitive tests. Male children tended to perform worse than females, but in the OLS results the difference is significant only for the PIAT-Math.

TABLE 3
Effects of Child Care (without Interactions)

	PIAT-Math		PPVT	
	OLS	Fixed Effects	OLS	Fixed Effects
Black	-1.948*		-13.803*	
	(.781)		(.921)*	
Hispanic	-2.667*		-10.557*	
	(.773)		(.913)	
Mother's AFQT	.096*		.163*	
	(.015)		(.018)	
Mother's education	.941*	.576	1.238*	-1.661*
	(.182)	(.766)	(.213)	(.784)
Log income	.532	1.616	1.232	-.076
	(.611)	(1.385)	(.670)	(1.333)
Poverty	-2.315*	.371	-4.429*	2.067
	(.903)	(1.470)	(1.071)	(1.596)
Mother's age	.361*	-.026	.332*	-.036
	(.145)	(1.491)	(.148)	(.203)
Siblings at age 3	-.790*	-.026	-2.593*	-.488
	(.387)	(.578)	(.417)	(.584)
Child's age	.131*	.171*	.111*	.124*
	(.043)	(.052)	(.032)	(.033)
Male	-1.095*	-.817	-1.157	-1.894*
	(.556)	(.673)	(.650)	(.712)
Motor skills	.111*	.079*	.185*	.070*
	(.024)	(.033)	(.027)	(.033)
Center care	.934	-.201	1.450	.101
	(.927)	(1.491)	(1.043)	(1.497)
Home care	-.161	.505	-.127	1.255
	(.667)	(1.039)	(.780)	(1.124)
R^2	.174	.026	.343	.041

Notes: N=2,008 children for PIAT-Math and 3,143 for PPVT. Samples restricted to children with at least one sibling in the selected age range. Models also include dummy variable indicators for missing values on all independent variables in the models.

Results for control variables are substantially different in the fixed-effects models because between-family variation has been ruled out. Thus race, ethnicity, and mother's AFQT, which do not vary within families, are excluded from the model. Mother's education, income, and poverty can in principle differ for children born at different times, but in practice within-family variation is minor and these variables have no effects (aside from a negative coefficient for mother's education on PPVT, which is probably meaningless). When considered within families, the number of siblings at age 3 is essentially an indicator of birth order, and this too has no impact on cognitive outcomes. Child's age, gender, and motor skills vary meaningfully within families, and these contribute to cognitive skills in the fixed-effects analyses, although the deficit for males is significant only in the case of the PPVT.

In subsequent models the coefficients for control variables remain essentially the same as in Table 3. Consequently we present only the coefficients representing effects of child care, child care interactions, and the background variables involved in the interactions.

Results from Interactive Models

Our central questions about care and inequality require models that allow interactions between type of care and aspects of social and economic backgrounds. We began by examining interactions for one background variable each, in separate, successive models.

Table 4 presents results for interactions between child care types and mother's education. OLS regression reveals no significant effects, but the fixed-effects models indicate significant effects of center-based care, differentially according to mother's education, for the PIAT-Math test. The main effect of -20.063, combined with the interaction term of 1.619, implies that center-based care is associated with lower math skills for children whose mothers have low levels of education, but higher skills for children whose mothers are well educated. For example, among children whose mothers completed 10 years of schooling, our model suggests that children in centers would score about 3.9 points lower ([10 × 1.619] - 20.063 = -3.873) than would children who received no nonmaternal care.

TABLE 4

Interactive Models for Child Care by Mother's Education: Selected Coefficients

	PIAT-Math		PPVT	
	OLS	Fixed Effects	OLS	Fixed Effects
Mother's education	.990*	.272	1.416*	-1.763*
	(.217)	(.801)	(.255)	(.835)
Center care	-.464	-20.063*	6.729	-4.053
	(6.283)	(10.164)	(6.805)	(9.617)
Center care	.106	1.619*	-.439	.347
× mother's education	(.504)	(.821)	(.547)	(.784)
Home care	1.662	-3.848	3.400	-3.473
	(4.229)	(7.167)	(4.923)	(7.766)
Home care	-.155	.387	-.300	.425
× mother's education	(.353)	(.606)	(.405)	(.648)
R^2	.173	.029	.343	.043

Notes: N=2,008 children for PIAT-Math and 3,143 for PPVT. Samples restricted to children with at least one sibling in the selected age range. Models also include controls for background variables noted in Table 3, as well as dummy variable indicators for missing values on all independent variables in the models.

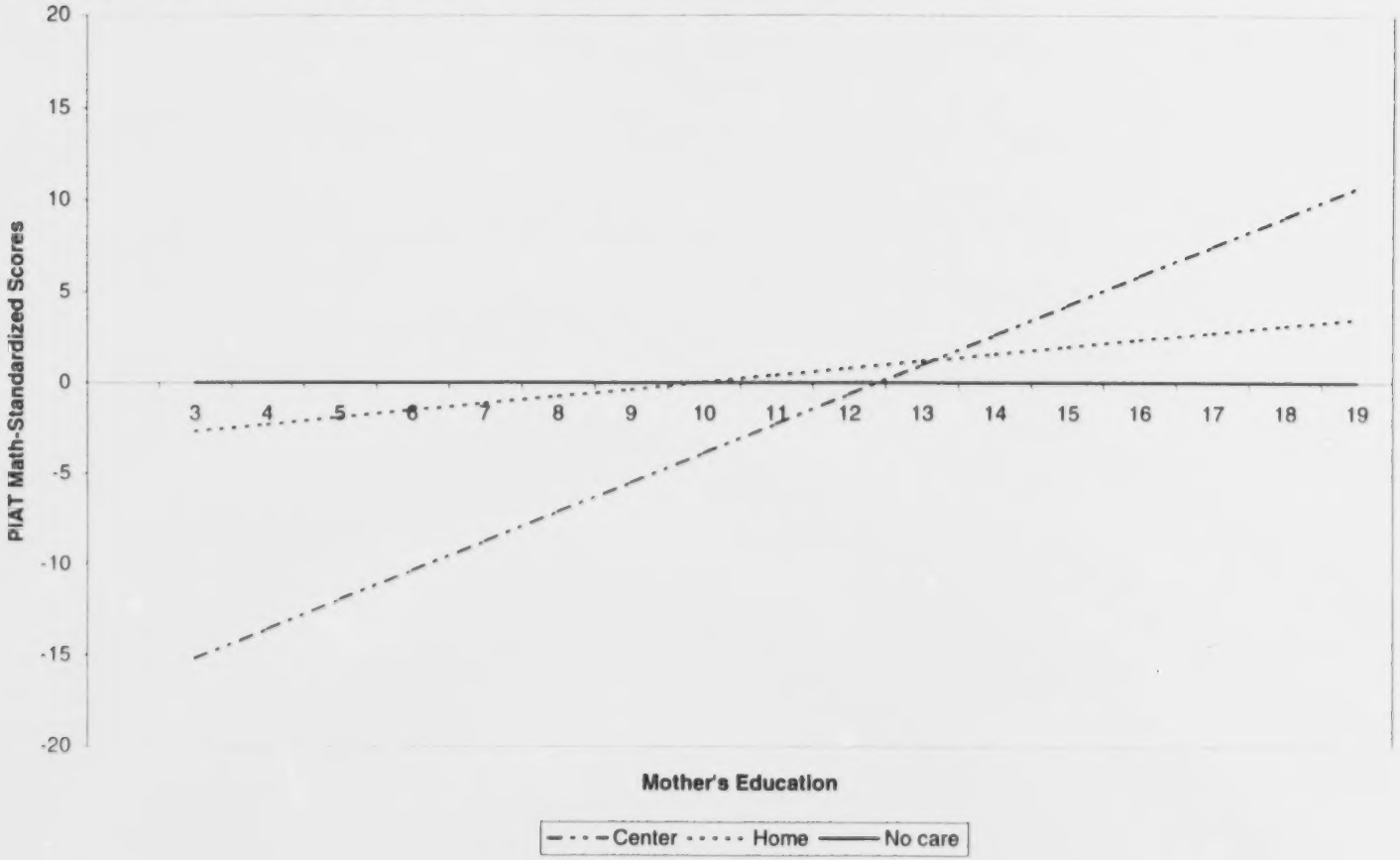
By contrast, among children whose mothers received 14 years of schooling, those in center care would score about 2.6 points higher ([14 × 1.619] - 20.063 = 2.603) than would those who remained with their mothers. These differences are substantial, amounting to about 15 percent to 20 percent of a standard deviation on the PIAT-Math. The differences are graphically portrayed in Figure 1.

The coefficients for care in the fixed-effects analyses for PPVT follow the same pattern for center care—a negative main effect and a positive interaction term. However, the coefficients are relatively small and nonsignificant. The coefficients for home-based care are not significant in any of the analyses.

In the next model, interactions with log income reveal the same pattern as for mother's education. Table 5 shows that for the PIAT-Math, the fixed-effects analysis implies that low-income children who attend center care lose out in cognitive skills, whereas high-income children benefit from center care. These effects are graphed in Figure 2. To get a sense of the magnitude of the differences, consider a child in poverty (around $13,000 for a family of four, or a log value of about 9.5) with one from a family with a middle-class income of around $40,000 (a log value of about 10.5). The poor child in center-based care would score 2.9 points lower on the PIAT-Math, whereas the middle-class child would score about 1.2 points higher, compared to similar children who did not enter child care.

We also examined interactions with poverty instead of log income. These suggested similar conclusions with regard to center-care effects on PIAT-Math—that is, center care lowers performance on this measure for children in poverty—but the coefficient was not statistically significant, probably because the number of children in poverty in our sample was not large enough to capture significant effects. The coefficients in Table 6 are of interest primarily because they suggest that the interaction between center care and income is roughly linear—the coefficient for all children in poverty, at -4.54, is approximately what is implied by the model of interactions with log income. We carried out additional analyses (not shown) using categorical versions of income and education, and these also suggested that

Figure 1. Interactive Effects of Mother's Education and Child Care



Note: Based on results in Table 4, fixed-effects model for PIAT-Math.

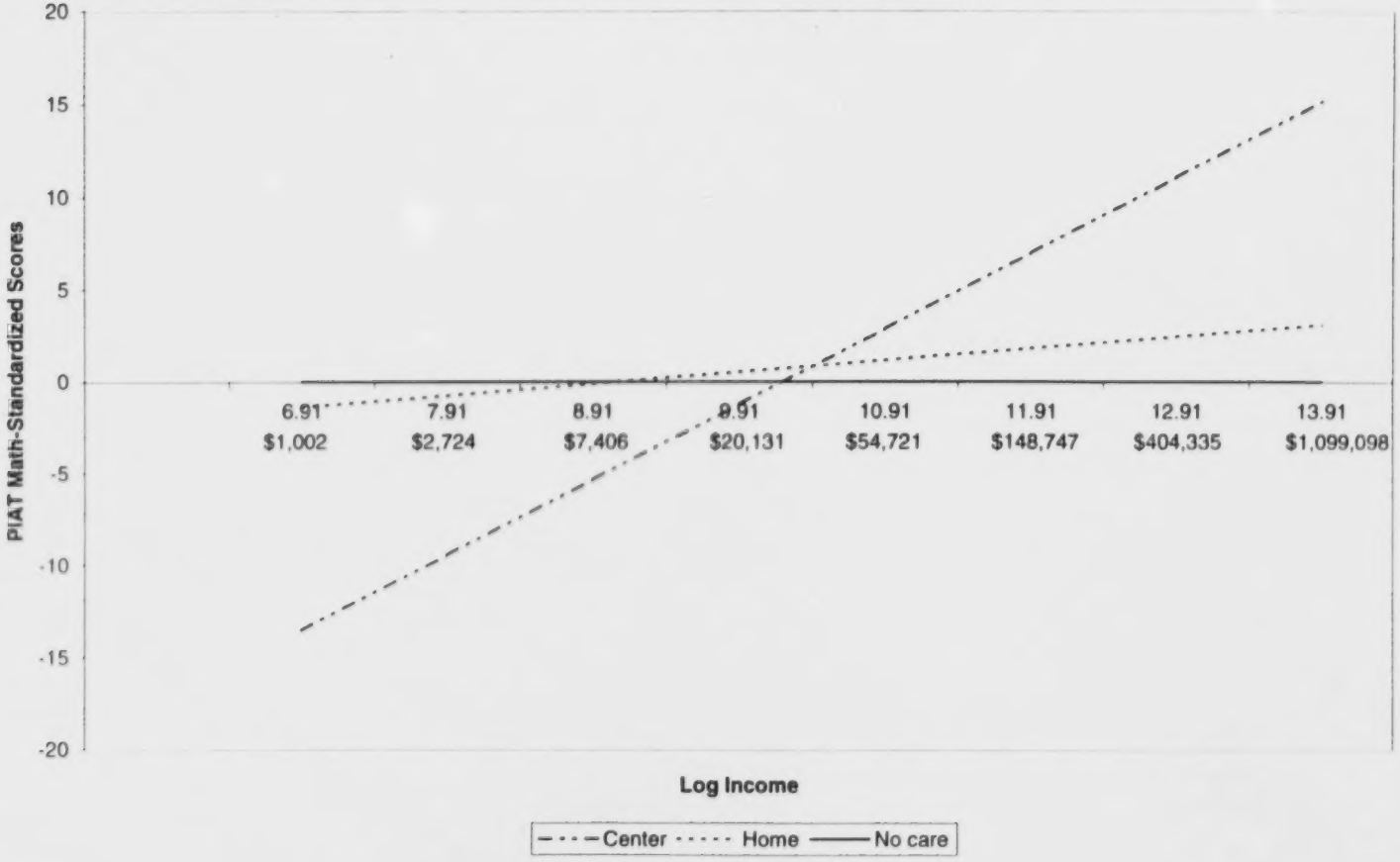
TABLE 5

Interactive Models for Child Care by Log Family Income: Selected Coefficients

	PIAT-Math		PPVT	
	OLS	Fixed Effects	OLS	Fixed Effects
Log income	.996	.844	1.979*	.094
	(.731)	(1.535)	(.792)	(1.460)
Center care	-4.556	-41.865*	.230	-4.717
	(12.769)	(20.112)	(13.113)	(18.120)
Center care	.515	4.101*	.095	.454
× log income	(1.256)	(1.981)	(1.292)	(1.787)
Home care	16.499	-5.811	24.959*	.280
	(9.562)	(15.526)	(10.800)	(15.921)
Home care	-1.658	.640	-2.477*	.081
× log income	(.948)	(1.554)	(1.065)	(1.585)
R^2	.174	.031	.343	.044

Notes: N=2,008 children for PIAT-Math and 3,143 for PPVT. Samples restricted to children with at least one sibling in the selected age range. Models also include controls for background variables noted in Table 3, as well as dummy variable indicators for missing values on all independent variables in the models.

Figure 2. Interactive Effects of Household Log Income and Child Care



Note: Based on results in Table 5, fixed-effects model for PIAT-Math.

TABLE 6

Interactive Models for Child Care by Poverty Status: Selected Coefficients

	PIAT-Math		PPVT	
	OLS	Fixed Effects	OLS	Fixed Effects
Poverty	-2.448*	.936	-5.775*	.925
	(.999)	(1.610)	(1.106)	(1.770)
Center care	.789	.651	.557	-1.255
	(1.039)	(1.693)	(1.187)	(1.719)
Center care	.121	-4.540	2.918	4.576
× poverty	(2.342)	(3.707)	(2.506)	(3.383)
Home care	-.308	.862	-1.105	.649
	(.766)	(1.207)	(.889)	(1.284)
Home care	.269	-1.129	4.078	1.435
× poverty	(1.566)	(2.273)	(1.869)	(2.481)
R^2	.174	.029	.343	.044

Notes N=2,008 children for PIAT-Math and 3,143 for PPVT. Samples restricted to children with at least one sibling in the selected age range. Models also include controls for background variables noted in Table 3, as well as dummy variable indicators for missing values on all independent variables in the models.

the interactions between care type and the background variables for PIAT-Math were linear. Interactive terms for race were also nonsignificant (not shown), and the interaction term for mother's AFQT by center care was marginally significant ($t = 1.68$, also not shown) and implied the same pattern as for mother's education.

Finally, we estimated a model that included interaction terms for care types by both mother's education and log income. Table 7 presents these results. In the fixed-effects results for PIAT-Math, the coefficient for center care is negative and statistically significant. The coefficients for the interaction terms are nonsignificant, but in light of the previous analyses they should be taken as meaningful. Together they imply findings similar to the results for separate interactions of income and education, and the combined results are graphically portrayed in Figure 3. Here, we see that for children whose mothers received 10 years of schooling, the "break-even" point (i.e., the point at which center care neither helps nor hurts) is about 11 on the log income scale, or about $60,000. By contrast the break-even point for mothers who received 14 years of schooling is about 10 on the log income scale, or about $22,000. Thus, it takes a very high income to compensate for a low level of maternal education. Moreover, because income and education are highly correlated, they tend to compound one another in the stratifying effects of center-based care.

Results from Nonparametric Models

Our analyses yielded significant results for interactive fixed-effects models with PIAT-Math scores. We used nonparametric methods to assess the robustness of these findings. We estimated the nonparametric results twice, once ignoring family membership and a second time focusing on differences within families. These dual efforts are analogous to our OLS and fixed-effects regression models.

Figure 4 displays results from our analyses of within-family differences for interactions with log income. Here the difference in PIAT-Math scores that occurred within families, between children receiving different types of care, is plotted according to log income. The top panel shows the difference

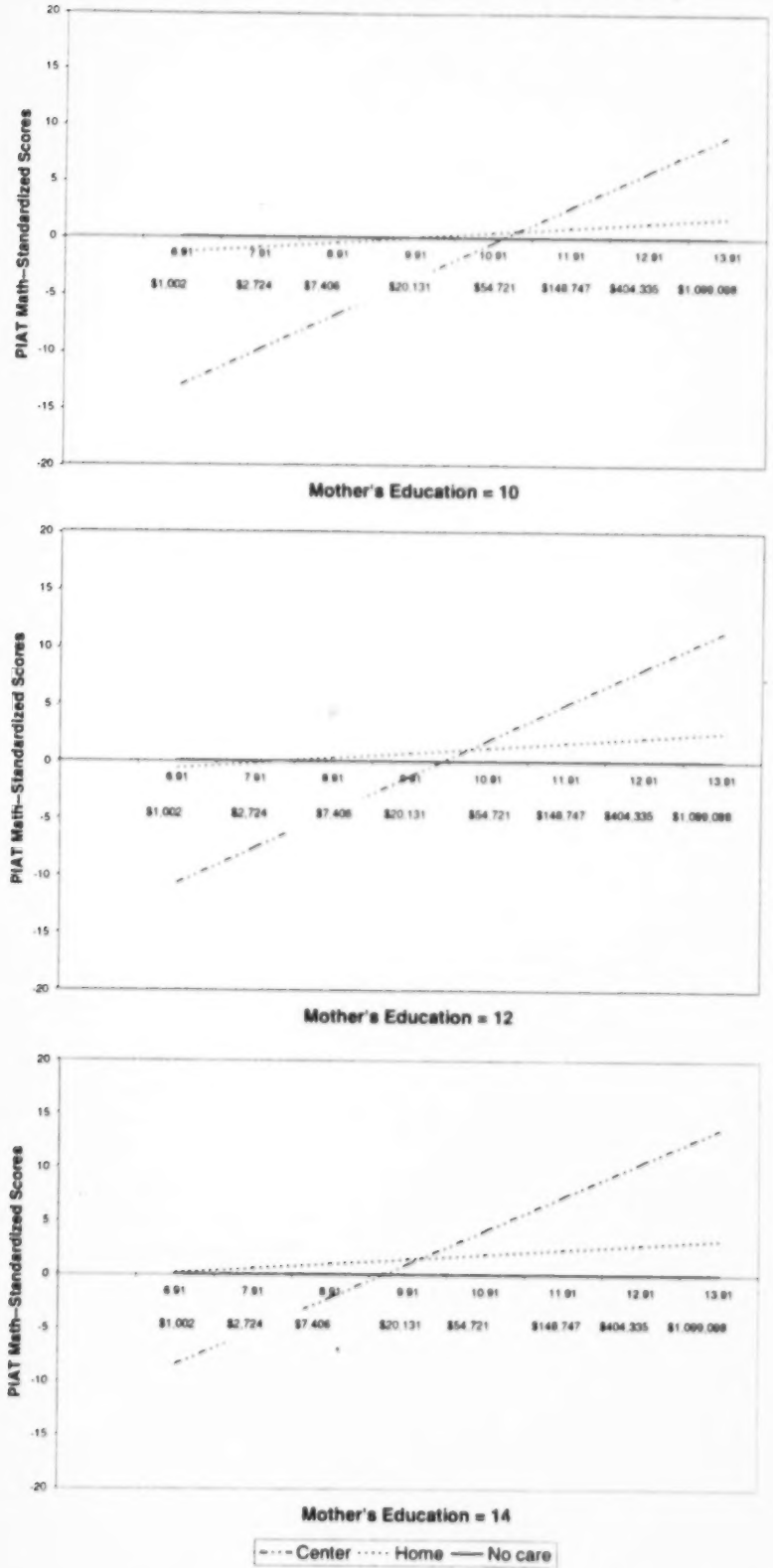
TABLE 7

Interactive Models for Child Care by Mother's Education and Log Income: Selected Coefficients

	PIAT-Math		PPVT	
	OLS	Fixed Effects	OLS	Fixed Effects
Mother's education	.926*	.369	1.316*	-1.863*
	(.223)	(.807)	(.264)	(.843)
Log income	1.022	.978	1.889*	.127
	(.743)	(1.552)	(.809)	(1.475)
Center care	-4.472	-46.193*	1.483	-6.527
	(12.827)	(20.390)	(13.178)	(18.348)
Center care	-.012	1.147	-.597	.265
× mother's education	(.553)	(.833)	(.605)	(.885)
Center care	.522	3.145	.695	.326
× log income	(1.377)	(2.131)	(1.428)	(1.947)
Home care	16.428	-8.134	24.711*	-2.239
	(9.572)	(15.165)	(10.824)	(16.173)
Home care	.150	.366	.080	.490
× mother's education	(.388)	(.651)	(.441)	(.687)
Home care	-1.829	.453	-2.553*	-.248
× log income	(1.042)	(1.672)	(1.158)	(1.683)
R^2	.173	.033	.343	.045

Notes: N=2,008 children for PIAT-Math and 3,143 for PPVT. Samples restricted to children with at least one sibling in the selected age range. Models also include controls for background variables noted in Table 3, as well as dummy variable indicators for missing values on all independent variables in the models.

Figure 3. Interactive Effects of Log Income, Mother's Education and Child Care for Varying Levels of Mother's Education



Note: Based on results in Table 7, fixed-effects model for PIAT-Math.

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Figure 4. Nonparametric Estimates of the Interaction of Child Care by Log Family Income

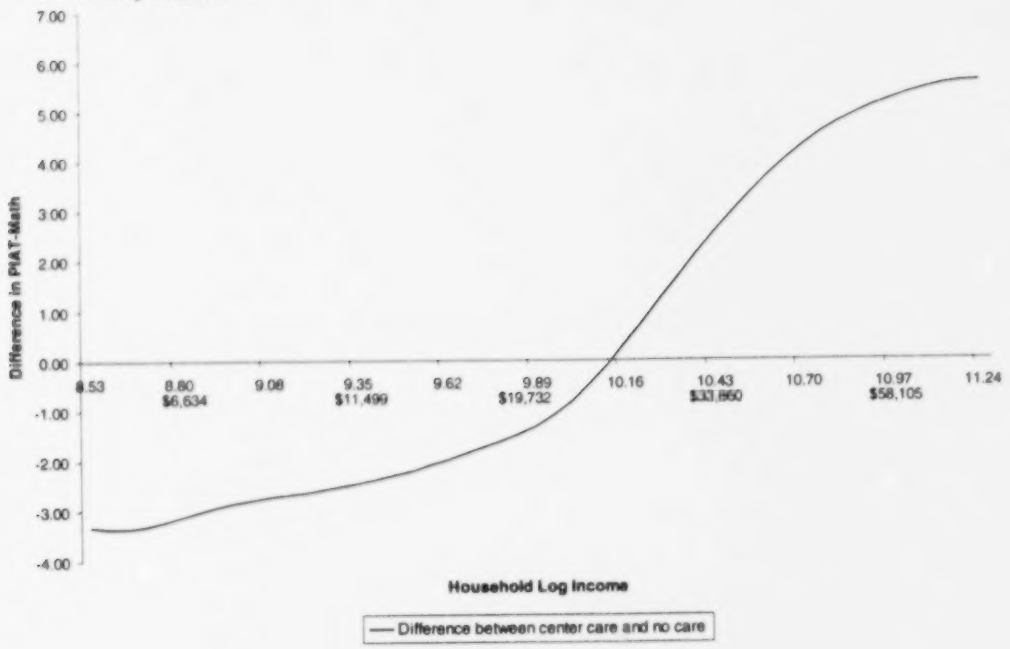


Figure 4. Nonparametric Estimates of the Interaction of Child Care by Log Family Income

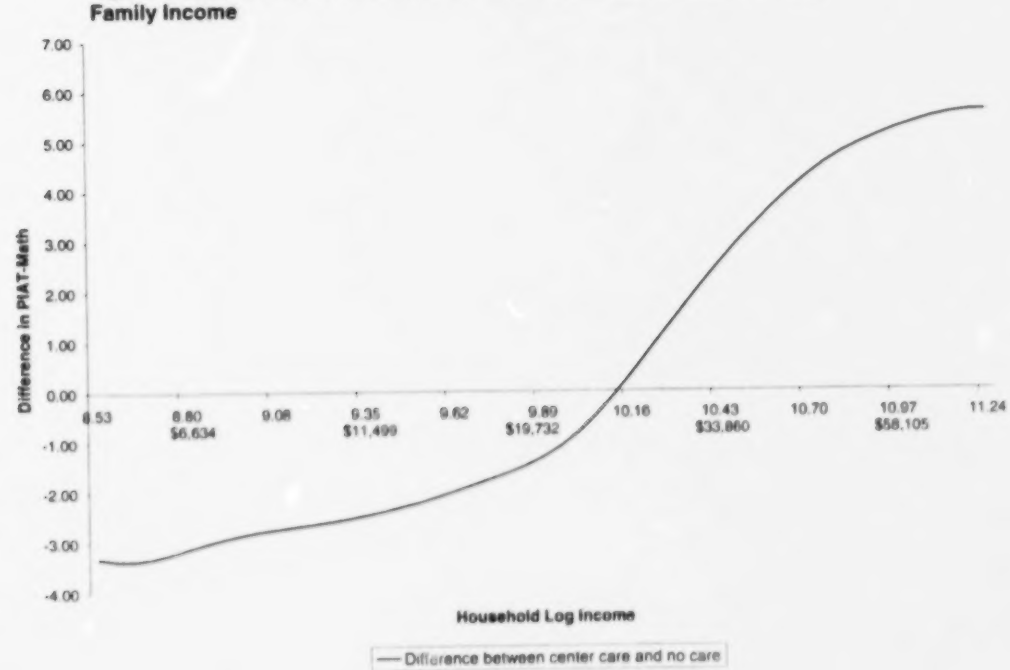
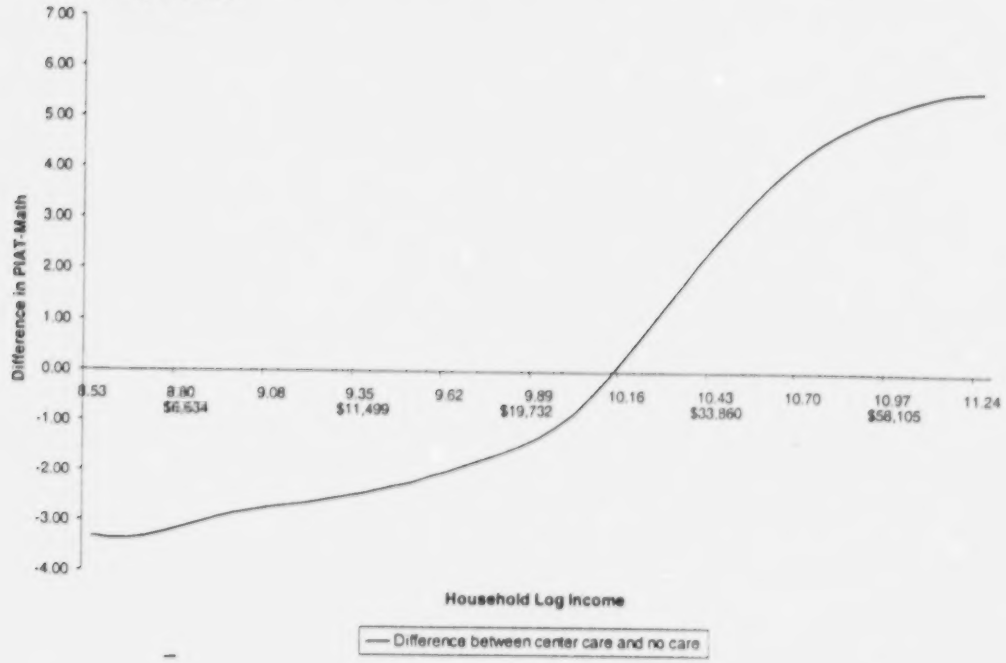
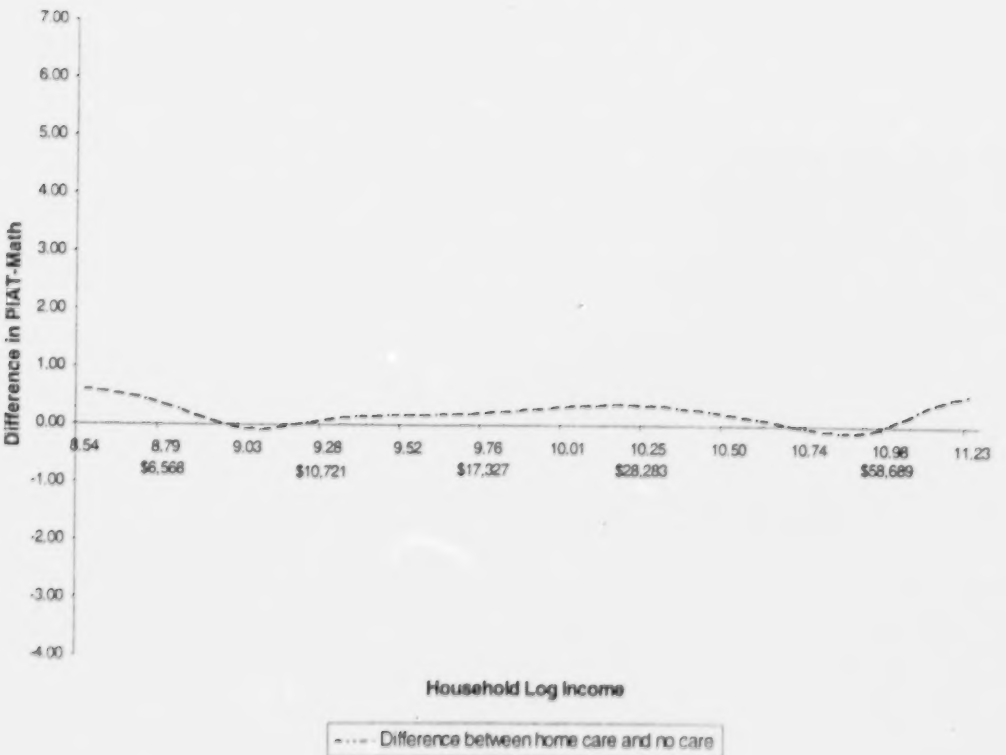


Figure 4. Nonparametric Estimates of the Interaction of Child Care by Log Family Income





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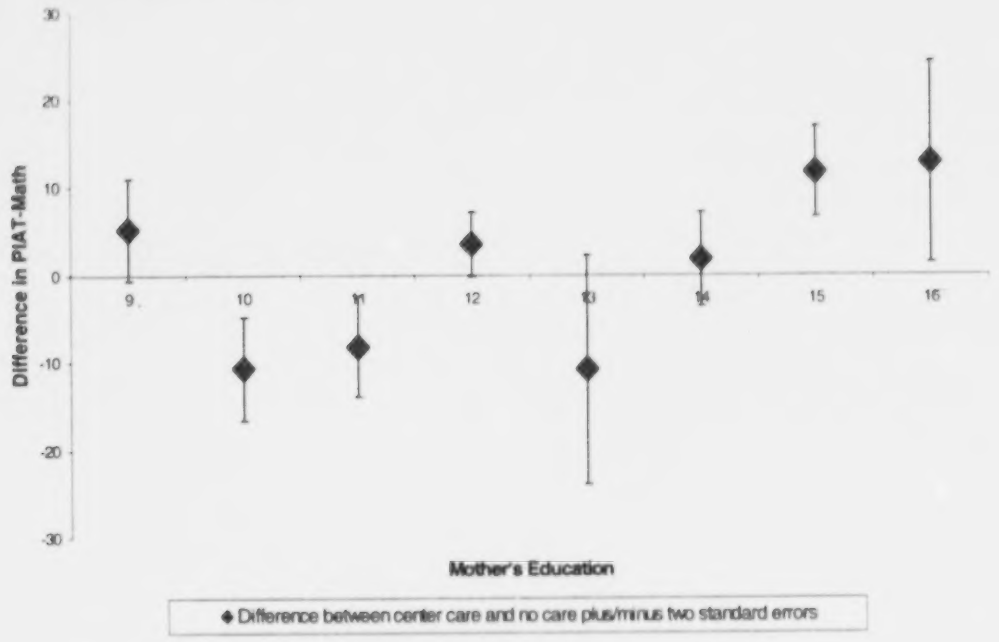
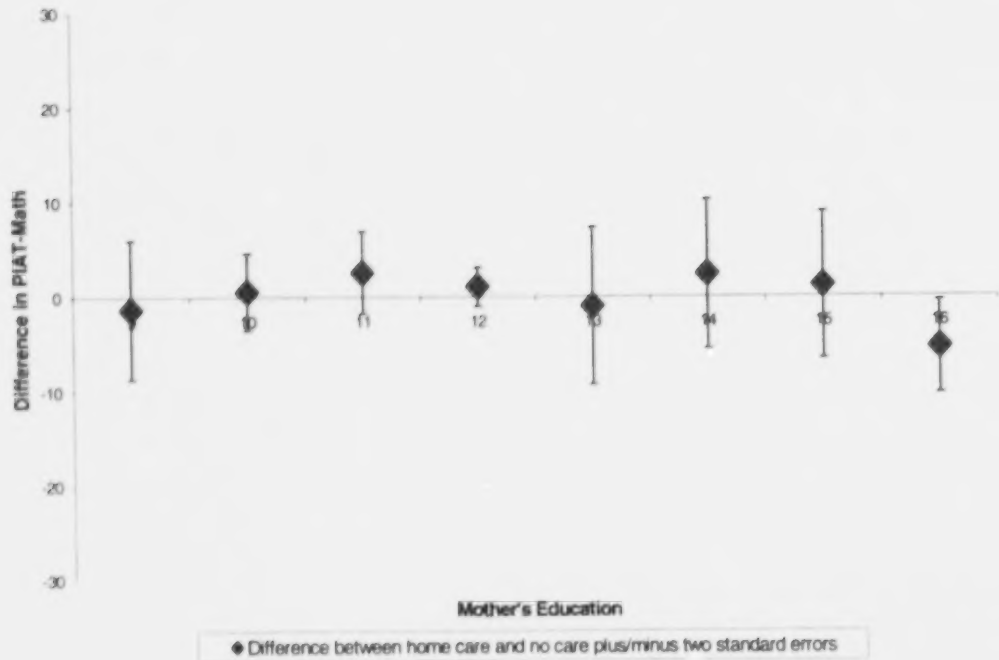
between children in center-based care and children who received no nonmaternal child care. The graph corroborates our fixed-effects results in that children from low-income families scored lower if they attended center-based care, but children from high-income families who attended center-based care scored higher. The nonlinearity evident in the plot may suggest, first, that the advantage of center care for high-income families is greater than the disadvantage for low-income families and, second, that there is a relatively steep rise in the benefits of center care between approximately $20,000 and $50,000. Because of the small number of cases upon which the graph is based—61 families with 139 children of whom at least one child attended center care and at least one child received no nonmaternal care—the nonlinearity should not be taken as conclusive, and we conclude merely that this analysis supports our finding of differential effects of center-based care. Our confidence in this conclusion is reinforced by the bottom panel of Figure 4, which reveals no difference in PIAT-Math for children in home care versus no nonmaternal care, also consistent with our parametric results.

Unlike log income, mother's education does not follow a continuous scale but is distributed categorically, with large clusters of cases at key points in the education system, such as 12, 14, and 16 years. For this reason we used a different method to generate nonparametric results for the interaction of mother's education with child care types. In Figure 5, we plotted within-family differences in PIAT-Math for each year of mother's education, including confidence intervals of two standard errors either way, to take account of the different number of cases at each point on the scale. The top panel of Figure 5 shows that PIAT-Math scores are lower for children in center care than for those in no nonmaternal care among children whose mothers received 10 and 11 years of schooling, and higher for those in center care whose mothers attended school for 15 and 16 years. For each of these years, the confidence intervals exclude the zero mark on the graph. These results are generally consistent with our conclusions based on the fixed-effects analyses, that the effects of center-based care vary according to mother's education. In the bottom

Figure 5. Nonparametric Estimates of the Interaction of Child Care by Mother's Education





panel of Figure 5, we observe essentially no difference between home care and no nonmaternal care, again consistent with our earlier findings.

DISCUSSION

The results of our analyses suggest several tentative conclusions about the cognitive effects of nonmaternal childcare for young children. Most strikingly, it appears that center-based child care is beneficial only to children from advantaged families—those whose mothers had high levels of education or high incomes or both. Children whose mothers had low levels of education and income actually suffered, according to our findings. These results did not appear in OLS analyses but emerged in fixed-effects models, which effectively eliminate unmeasured aspects of families that may be associated with choosing different forms of care. The findings are supported by the consistent results for mother's education and income, and their robustness is upheld in nonparametric regressions, which generally replicate the parametric results.

Nonetheless the findings remain tentative. Although we prefer the fixed-effects to the OLS results because of their treatment of selection bias, this necessarily means we have ignored families with only one child. Ignoring such families not only reduces the representativeness of our sample but also tends to exacerbate the bias in the NLSY child sample toward disadvantaged children, because it is more likely to include children born when their mothers are young than those born when their mothers are older. In addition, even though the fixed-effects analyses include over 2,000 children for the PIAT-Math (and over 3,000 for the PPVT), estimates of care-type effects really derive from the 670 children in the 296 families that had different children in different types of child care. In sum, the effective sample for our results is small and of questionable representativeness, so they remain as speculative as they are provocative.

We found no meaningful differences in cognitive skills for children in home care compared to those only in maternal care. This means that in contrast to children from advantaged families, who benefit most from centers, children from disadvantaged families are better off in day care homes than in day care centers. The effects of center care we uncovered were statistically significant only for mathematical performance, not verbal skills. This pattern is consistent with research on schools, which typically finds more powerful effects of schools on mathematical than on verbal outcomes (e.g., Gamoran, 1987). The similarity implies that it is the specific cognitive practices of centers for well-off children which confer benefits, rather than a general cultural style or verbal environment.

Assuming the differential effects of center care are real, what are the underlying mechanisms that bring them about? Our model is a reduced-form analysis, and we have hypothesized several processes through which the effects may occur. First, there are no doubt differences in quality between centers attended by well-off children and those attended by poor children. These differences in quality operate over and above differences in family environments to widen the cognitive gaps that already exist. Second, more-educated parents may be better equipped to make the best choices for their children. Thus, even when two centers cost the same, or are equivalent on standard measures of quality, parents who are better informed may choose centers that fit the specific needs of their children more effectively. Third, wealthier and more-educated families may reinforce the cognitive effects of day care centers, whereas poor families may not be equipped to do so. In light of the significant results for mathematics but not verbal outcomes, this interpretation seems particularly compelling. Young children from well-educated families are more likely to have opportunities to engage with the same kind of mathematical problems at home that they encounter in day care. Yet to account for the negative effects of center care for the children of the poor, it seems necessary to invoke an explanation that focuses on the differential quality of center care. Probably both types of processes are at work. If the gains from center care for advantaged

children are greater than the losses for disadvantaged children, as suggested in our nonparametric results, then the well-off children may benefit both from better care and from better reinforcement at home.

If our results are to be taken seriously, their policy implications are severe. We know that changes in welfare requirements will place many more children of low-income and poorly educated mothers in some sort of day care. If these children end up in low-cost day care centers, and if the quality of care is the same as currently exists, then our results suggest that cognitive inequality among young children will be greater in the future than it is at present. Our findings are too tentative for such sweeping conclusions, but they surely call for more attention to this problem. More research is needed, first to corroborate our findings and second to look more carefully at the mechanisms through which our findings occurred, assuming they are sustained by further research. In addition, despite the limitations of our study, the findings of inequality are enough to raise the possibility that standards are needed for day care centers to ensure that the quality of care for children from poor families is not so low as to damage the prospects of the children who attend.

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